

NOISE ELEMENT

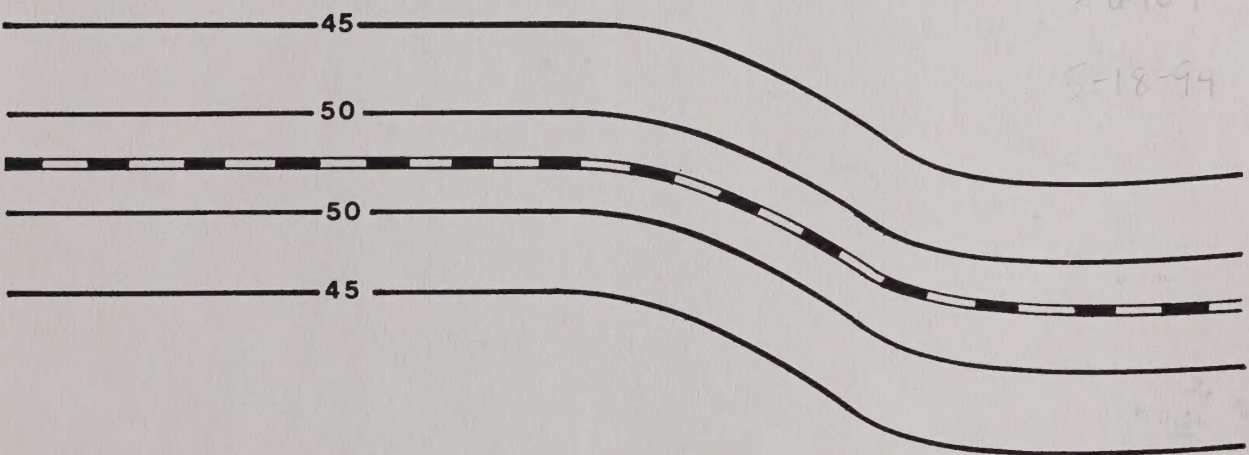
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City of Martinez

ADOPTED NOVEMBER 20, 1985

NOISE ELEMENT
OF THE
GENERAL PLAN

City of Martinez

Prepared by

City of Martinez
Planning Department

and

Edward L. Pack Associates, Inc.
Santa Clara, California

ADOPTED BY THE CITY COUNCIL ON
NOVEMBER 20, 1985
RESOLUTION NO. 194-85



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RESOLUTION NO. 194-85

RESOLUTION AMENDING THE MARTINEZ GENERAL PLAN
BY ADDING THE NOISE ELEMENT

WHEREAS, the Planning Commission has recommended approval of the proposed Noise Element; and

WHEREAS, both the Commission and the City Council have held public hearings as required by State law; and

WHEREAS, the Council adopts the statement of no significant environmental impact (Negative Declaration) as adopted by the Planning Commission; and

NOW, THEREFORE, BE IT RESOLVED by the City Council that the General Plan be amended by adding the attached Noise Element.

* * * * *

I HEREBY CERTIFY that the foregoing is a true and correct copy of a resolution duly adopted by the City Council of the City of Martinez at a regular meeting of said Council held on the 20th day of November, 1985, by the following vote:

AYES: Councilmembers Hernandez, Pollacek, Vice Mayor Langley and Mayor Menesini.

NOES: None.

ABSENT: Councilmember Radke.

LAWRENCE J. KOWALSKI
City Clerk, City of Martinez

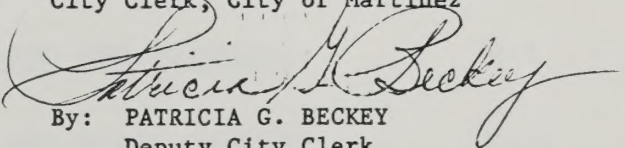

By: PATRICIA G. BECKEY
Deputy City Clerk

TABLE OF CONTENTS

PREFACE

I. INTRODUCTION

A. Purpose	I-1
B. General Objectives, Goals and Policy	I-2
C. Community Action Program	I-4

II. FUNDAMENTALS OF SOUND

A. Sound and Noise	II-1
B. The Measurement of Sound	II-1
C. Community Noise Ratings	II-2
D. Major Sources of Community Noise	II-5
E. Noise Control Techniques	II-9

III. SCOPE OF NOISE SURVEY AND YEAR 2000 PREDICTIONS

A. Existing Noise Levels	III-1
B. Future Noise Levels	III-3

IV. NOISE EXPOSURE INVENTORY

IV-1

V. NOISE CRITERIA FOR LAND USE PLANNING

V-1

VI. MITIGATING MEASURES FOR NOISE CONTROL

VI-1

A. Administrative Controls	VI-1
B. Technical Noise Control Measures	VI-4

PREFACE

This Noise Element of the General Plan of the City of Martinez is intended to satisfy the State of California requirements for environmental noise planning and control. California Government Code Section 65302(g) requires a Noise Element in all city and county General Plans. The state code requires that the Noise Element be expressed in quantitative terms, showing contours for existing and future noise levels associated with current and proposed major transportation elements. The major sources of environmental noise in the City of Martinez include: (1) highways, (2) arterials and major local streets, (3) railroad passenger and freight line operations, (4) local industrial plants, (5) the sewage treatment plant, and (6) other ground sources that may at times contribute to the community noise environment.

This Noise Element includes a statement of general policy of the City of Martinez regarding noise and mitigation measures. It identifies noise levels along various selected major streets and roadways, discusses effects of noise on people and includes noise standards for various land uses.

The Noise Element, when adopted, will be a useful tool in land use planning and decision making on developments along major transportation elements which are generators of high noise levels.

TABLE OF CONTENTS

VII.	<u>RELATIONSHIP WITH OTHER GENERAL PLAN ELEMENTS</u>	VII-1
------	--	-------

APPENDIX

- A. Noise Survey Summary
- B. Definitions

I. INTRODUCTION

A. Purpose

The purpose of the Noise Element of the General Plan is to provide an understanding of noise conditions in the City and to develop policy statements and goals for noise control. Implementation of this Element is designed to promote a comprehensive and long range program of achieving acceptable noise levels throughout Martinez. The Element is also designed to bring the City into compliance with Section 65302(f) of the State of California Government Code enacted by the State Legislature in 1972 and with subsequent amendments.

The Element has been prepared in quantitative terms, including maps, showing noise contours of present and future noise levels associated with existing major transportation elements. Included herein are noise levels associated with the following significant transportation elements within the City of Martinez:

- . Highway 4
- . Southern Pacific Railroad
- . Major arterials and local streets

Evaluation of the acquired field data was made for the purpose of developing guidelines for the Land Use and Circulation Elements and a Noise Ordinance.

The purposes of the Noise Element can be summarized as follows:

1. To gather information on existing and future community noise levels.
2. To evaluate noise levels and impacts on existing and future planned developments.
3. To increase the community's awareness of the need to control and reduce levels in areas of excessive noise.
4. To establish objectives, goals and action programs to guide public and private planning to attain acceptable levels in the City.

5. To fulfill the mandatory General Plan Element provisions as set forth in the California Government Code Section 65302 (f).

B. General Goals, Objectives and Policy

The goal of the City of Martinez is to maintain or reduce noise intrusion levels in all areas of the City to levels considered acceptable by the community.

To achieve the goal of acceptable noise levels in all sections of the City, the following objectives and statement of policy are presented:

1. The preservation and enhancement of the acoustical environment of the City of Martinez is recognized. In recent years, noise has been identified as a major environmental pollutive agent with substantial evidence documenting its detrimental effects on human health and well-being. The U.S. Environmental Protection Agency has stated that some 80 million people are significantly impacted by noise, half of whom are exposed to levels that can damage hearing or otherwise affect health. In addition to its potential hearing damage effects, noise acts as a source of annoyance, discomfort, sleep interference and disrupts communication and relaxation. The City, therefore, should adopt specific plans and anti-noise measures to prevent and suppress objectionable noise levels throughout the community.
2. The City of Martinez should cooperate with Contra Costa County, the State of California, the Federal Government and private companies in a joint effort to plan, control and attain the preservation of a quiet environment.
3. The City should encourage private interests to devote resources to the cause of a quiet environment and its preservation.

4. The City should integrate the Noise Element into the Land Use and Circulation Elements and develop a local Noise Ordinance guided by noise data from the Noise Element.
5. The City should develop and implement an effective noise ordinance having appropriate noise level limits for various equipment, activities and land use categories, including recreational activities.
6. The City should amend the building code to include the "Noise Insulation Standards" of the California Administrative Code, Title 25, Article 4, Section 1092, effective August 22, 1974, Ref. 2. The State's standards apply to all applications for building permits for multifamily dwellings, hotels and motels.
7. Parks and recreational areas should be protected from excessive noise to permit the enjoyment of sports and other leisure time activities.
8. Open space should be used, wherever practical, to isolate noise sources from sensitive land uses by the employment of adequate separation distances.
9. The City should discourage the establishment of acoustically incompatible land uses in juxtaposition or adjacency to each other.
10. The City should require the use of noise mitigating devices, such as wall barriers, berms, mufflers, sound traps, baffles, etc., to reduce noise intrusion from transportation and fixed sources.
11. The City should initiate an on-going noise assessment program for the purpose of determining changes in noise levels over time.

C. Community Action Program

The following action program elements are considered essential to the initiation of an effective plan to enhance the community's acoustical environment:

1. Amend the Martinez municipal code to require that all new multifamily residential developments, hotels and motels subject to C.A.C. Title 25 to be located in zones exceeding 60 dB CNEL, or residential developments to be located within 500 ft. of any major arterial, highway, railroad or mass transit line shall have on-site noise measurements to determine existing and future levels, and that noise attenuation provisions be included in the design of those developments found to exceed adopted standards.
2. Review the City code to determine if noise compatibility exists between various land uses permitted by each zoning district.
3. Review the history of noise complaints from the community; develop and adopt a noise ordinance to prohibit or control annoying and unnecessary noise within the City.
4. Establish acceptable exterior and interior noise standards. A day-night level (L_{dn}) of 60 dB is recommended as the standard for exterior noise and 45 dB L_{dn} as the interior standard.
5. Initiate active enforcement of the noise regulations of the State Motor Vehicle Code. The City of Martinez Police Department enforcement of the Motor Vehicle Code will help to reduce impacts from the more offensive vehicles.
6. Monitor commercial truck routes and operations within the City to minimize noise impacts on noise sensitive areas.
7. Encourage State legislation for the control of noise emissions from trucks, buses, motorcycles and automobiles. Seek funding for construction of sound barriers to protect residential areas already over the standards in #4, above (example: Forest Hills) due to traffic noise.

8. Encourage the State and County to design new roadways with sound attenuating features. Depressed or elevated roadways, noise barrier walls, berms and adequate separation distances will reduce traffic noise impacts on adjacent areas.
9. The City should monitor and control noise emissions from Southern Pacific Railroad operations within the City. If the City adopts noise standards equivalent to the Federal Rail Standards, the Federal Department of Transportation will provide enforcement assistance.
10. Develop and enforce noise ordinance standards applicable to construction and maintenance activities.
11. Evaluate City owned maintenance equipment and tools for noise emission levels. Adopt a policy of replacing noisy equipment with newer, quiet equipment items.
12. Develop a policy to encourage City hired contractors and maintenance companies to purchase and use quiet equipment and tools.
13. Maintain liaison with County and State highway and other transportation agencies regarding noise control planning and reduction of noise from existing facilities.
14. Inform residents of various means available to limit noise intrusion from the use of noise insulation techniques.
15. Require that feasible engineering noise control measures identified in Environmental Impact Reports on proposed projects be incorporated at the time of project initiation.
16. In established residential neighborhoods, construction activities should be limited by the Noise Ordinance to be adopted at a later date.
17. Study the feasibility of assigning the administration of a noise abatement program to a single City agency.

II. FUNDAMENTALS OF SOUND

A. Sound and Noise

Sound is a result of pressure alterations propagated in an elastic medium. In air, sound consists of changes in pressure that alternate above and below the atmospheric pressure. When vibrating objects accelerate the air next to them, alternate waves move through the air similar to waves in water. As the waves encounter an object, a force is exerted which causes the object to move. When the object is the human ear drum, forces are transmitted to the middle and inner ear sections where each vibration is ultimately carried to the brain and is interpreted as sound. Sounds have various characteristics including variations in intensity (loudness), frequency (pitch), incidence (constant vs. intermittent), and complexity (purity of pitch).

Noise is usually defined as unwanted sound. At times it is difficult to objectively describe noise since what is desirable sound to one person is noise to another individual. Often the intensity, duration, time of occurrence and frequency components of the sound contribute to its identification as sound or noise. There are, however, many sounds which originate from transportation sources that are categorized as noise by most everyone. Generally, assessments on which sounds are noise vary by the individual's experience, learning or activity state. Often strange sounds are considered as noise compared to more familiar sounds. Random sounds are usually more disturbing than predictable sounds. Sounds which occur during activities requiring quiet are perceived as being noisier than sounds of the same intensity occurring during a more active period. Research indicates that loud, high-pitched, intermittent sounds are more annoying and are considered the "noisiest".

B. The Measurement of Sound

The measurement of sound involves two basic problems, a very wide range of pressures and the nonlinear manner in which the ear responds to sounds of varying intensity and frequency. It has been found that the human ear responds logarithmically to changes in loudness of an applied stimulus. Therefore, most sound measuring instruments are calibrated to read in terms of the common logarithm the ratio of sound pressures. The meter reading is called the sound pressure level and is expressed in decibels (dB).

Zero (0 dB) on the decibel scale is the lowest sound level that a healthy human ear can detect under very quiet conditions. As the sound level measuring scale is logarithmic (not in linear units like inches or pounds) a wide range of sound level changes can be expressed without using large, unwieldy numbers. For example, 10 decibels is 10 times more intense than 1 decibel, 20 decibels is 100 times greater than 1 decibel and 30 decibels is 1000 times greater than 1 decibel in sound intensity. Typical "A" weighted sound levels for various sources measured at the distances shown are listed below:

<u>Source</u>	<u>Distance</u>	<u>Sound Level (dBA)</u>
Soft whisper	5 ft.	30
Quiet office	--	40
Light traffic	100 ft.	50
Average speech	3-5 ft.	60
Automobiles	50 ft.	70
Inside bus	--	80
Inside subway train	--	90
Freight train	25 ft.	100
Automatic punch press	3 ft.	110
Pneumatic chipper	5 ft.	120
Threshold of pain	--	130

Sound level meters are usually provided with three weighting networks, identified as A, B and C. These networks enable the meter to approximate the response of the ear at sound levels of about 40, 70 and 100 dB. Therefore, most sound level meters can be adjusted to select the proper network by turning a switch. However, the "A" weighting network is specified in nearly all standards and regulations and is the most commonly used network for measurement of community noise levels.

C. Community Noise Ratings

In noise measurement and abatement work there is the need to relate subjective response to the noise environment to some convenient measurement aspect of that environment. To assess the severity of a noise exposure, an appropriate criterion must be selected. The selection of a criterion first involves the choice of an appropriate rating scale. In some situations a simple sound level meter reading is adequate while in other cases a knowledge of the spectrum of the noise and time characteristics is required. Various rating scales

have been developed that require information on the distribution of levels of fluctuating noise, time duration, repetition rate for impulsive and intermittent noise, background levels, time of occurrence, etc. Thus, rating scales are in use related to loudness, annoyance, articulation and other factors.

A variety of rating scales have been developed which offer advantages and disadvantages. For measurements of overall noise levels, the A-weighted reading is often satisfactory. However, with constant fluctuations in urban noise levels, it is not adequate to define noise as so many decibels. Urban noise must be defined in statistical terms which account for the time-varying pattern of the noise.

A series of statistical descriptors have been developed which represent the noise levels exceeded a given percentage of the time. These descriptors are commonly used to describe community noise and are as follows:

- L_{10} - A noise level exceeded for 10% of the time, considered to be an "intrusive" level.
- L_{50} - The noise level exceeded 50% of the time, representing an "average" or median level.
- L_{90} - The noise level exceeded 90% of the time, designated as a "background" noise level.
- L_{eq} - The continuous equivalent level is that level of a steady noise having the same energy as a given time-varying noise. The L_{eq} thus represents the decibel level of the time-averaged value of sound energy or sound pressure squared. The L_{eq} descriptor is used to calculate the day-night level (L_{dn}) and the Community Noise Equivalent Level (CNEL).

The noise scale utilized in this Noise Element is described in terms of the day-night sound level (L_{dn}). The L_{dn} rating is determined by the cumulative noise exposures occurring over a 24 hour day in terms of A-weighted sound energy. The 24 hour day is divided into two subperiods for the L_{dn} index, i.e., the daytime period from 7:00 a.m. to 10:00 p.m., and the nighttime period from 10:00 p.m. to 7:00 a.m. A 10 dBA weighting factor is applied (added) to the noise levels occurring during the nighttime period to account for the greater sensitivity of people to noise during these hours.

The L_{dn} is calculated from the measured continuous equivalent sound level (L_{eq}) in accordance with the following mathematical formula:

$$L_{dn} = [(L_d + 10 \log_{10} 15) \& (L_n + 10 + 10 \log_{10} 9)] - 10 \log_{10} 24$$

where: $L_d = L_{eq}$ for the daytime (7:00 a.m. to 10:00 p.m.)
 $L_n = L_{eq}$ for the nighttime (10:00 p.m. to 7:00 a.m.)
 24 indicates the 24 hour period
 & denotes decibel addition

The L_{10} level has been used by the Federal Highway Administration (HFWA) and by the California Department of Transportation for highway noise assessment and as the design criteria level for highway construction.

The State of California in Title 25 utilizes the Community Noise Equivalent Level (CNEL) rating developed originally for airport and aircraft noise assessment in California. This scale divides the 24 hour day into three periods, daytime, evening and nighttime, with a 5 and 10 dB penalty for the evening and nighttime noise, respectively. The CNEL values are calculated from the measured L_{eq} values in accordance with the following mathematical formula:

$$CNEL = [(L_d + 10 \log_{10} 12) \& (L_e + 5 + 10 \log_{10} 3) \& (L_n + 10 + 10 \log_{10} 9)] - 10 \log_{10} 24$$

where: $L_d = L_{eq}$ for the daytime (7:00 a.m. to 7:00 p.m.)
 $L_e = L_{eq}$ for the evening (7:00 p.m. to 10:00 p.m.)
 $L_n = L_{eq}$ for the nighttime (10:00 p.m. to 7:00 a.m.)
 24 indicates the 24 hour period
 & denotes decibel addition

As can be seen from the above equations, the numerical difference between the L_{dn} and CNEL values calculated from the L_{eq} is less than 1 unit. Therefore, for all practical purposes the two scales can be considered equivalent. As the CNEL computations are more complex than in the L_{dn} scale, the L_{dn} system is preferred.

D. Major Sources of Community Noise

There are numerous sources that contribute to the noise level in a community. The dominant sources are often transportation vehicles: motor vehicles, aircraft, railroads, mass transit systems, etc. Other fixed sources include construction equipment, industrial facility equipment, air-conditioning systems, automatic car washes, etc. Another group of noise sources in residential areas includes animals, power lawnmowers, leaf blowers, chain saws and a variety of power tools. All major sources of noise can be included in five categories:

- . Transportation Systems
- . Industrial Plant Equipment
- . Construction Equipment
- . Air-Conditioning, Heating and Ventilating Equipment
- . Miscellaneous sources including power tools, animals, and human activities

1. Transportation Systems

This section is concerned with urban noise problems resulting from the use of internal combustion engine powered surface transportation vehicles. As motor vehicles are the most widespread source of community noise, any effective planning for noise control and mitigation must consider this origin of noise. In most urban areas, the steady background level results from the total contribution of noise from automobiles, heavy-duty diesel trucks and light-duty gasoline powered trucks. Near major roadways there will be high background levels and high noise peaks from trucks that are considerably more noisy than the general background level.

a) Truck Noise

Trucks generate considerably higher levels of noise than automobiles, and therefore, contribute substantially to the urban noise problem. In both diesel and gasoline powered trucks, exhaust, traction, engine and drive train noises contribute to the overall noise emission levels. All trucks produce exhaust noise that is usually the dominant noise source. In addition, engine noise is transmitted through various openings including the radiator and spaces below the engine compartment. Truck drive-trains radiate considerable noise from the transmissions and differentials. Other truck noise sources include the air-brake systems, chassis, springs, couplings, chains and traction noises from the tire-roadway interface.

Truck tire noise becomes an important factor at moderate to high speeds when air pumping action between the tire and roadway surface becomes significant. Also vibrational modes of the tire body are created from contact with the roadway surface which results in noise generation. Noise level differences up to 20 dB can be expected from various tire tread designs and road surface finishes. Until quieter truck tires are designed, little or no significant reduction in truck noise will be experienced.

b) Automobile Noise

Automobiles create lower noise levels than heavy trucks and buses, however, at high speeds autos can be major noise generators. With autos, tire and exhaust noises are the dominant sources. At highway speeds above 35 mph, tire noise will be dominant. At speeds below 35 mph, exhaust and sometimes air intake noise will exceed other sources. Therefore, significant noise reductions can be realized from the use of more effective mufflers and quiet tire tread designs.

c) Motorcycle Noise

Another source of annoyance arises from the operation of motorcycles in residential areas. Recent studies have identified the motorcycle as the second most offensive vehicle in urban zones. Motorcycle exhaust roar interference with communication and sleep annoys many persons because they believe the driver could control vehicle noise generation. Motorcycle noise annoyance can be reduced by use of quieter engines, better mufflers and driver operation to minimize noise emission levels.

2. Industrial Plant Equipment

Various industrial plants can create noise from exterior and interior equipment which at times can be annoying to nearby industrial, commercial and residential neighbors. Frequently, industrial plants have such equipment as: air intake or discharge fans, openings for equipment rooms containing water chillers, compressors, pumps, presses, machine tools and other noisy equipment. Noise controls in the form of noise mitigating hardware or time limitations on operation of the offending equipment can resolve the problem. As most of the industrial plants in Martinez are fully enclosed, industrial plant noise problems should be minimal.

3. Construction Equipment

During construction of projects, high noise levels will be created temporarily. Construction is carried out in several discrete phases, each of which has its own mixture of equipment and consequently its own noise characteristics. The site preparation and construction phases will generate sound levels ranging from approximately 70 to 90 dBA at 50 ft. distances from heavy equipment and vehicles. Dozers, scrapers and dump trucks for example, are rated by the U.S. Environmental Protection Agency at 87 dBA, 88 dBA and 88 dBA average level, respectively, at 50 ft. distances.

Construction vehicles and equipment are frequently diesel-powered and produce a characteristic noise which is primarily concentrated at low frequencies. The noise fluctuates as a result of equipment movement on the site and vehicles act as point sources of sound which will diminish with distance at the rate of 6 dBA for each doubling of the distance from a noise source over open terrain.

For example, the 70 to 90 dBA noise range at 50 ft. will reduce as follows:

<u>Noise Range</u>	<u>Distance</u>
70 to 90 dBA	50 ft.
64 to 84	100
58 to 78	200
52 to 72	400
46 to 66 dBA	800 ft.

During construction, sound level increases of 20 to 40 dBA can occur near the project boundary. Sound level increases typical of construction activity represent a "great increase" for temporary periods.

Generally, the short-term site preparation phase which requires the use of heavy equipment such as bulldozers, scrapers, trenchers, trucks, etc., will be the noisiest. The following building construction and equipment installation phases will be quieter and on completion of the project, the project's sound levels will reduce essentially to the traffic noise levels.

Noise mitigation measures can be instituted during construction of a project by using quieter than normal or "new technology" equipment; operating fewer pieces of equipment at a time; scheduling noisy operations for the daytime hours to avoid the more sensitive evening and nighttime hours; utilizing temporary enclosures, berms or noise barriers; and by arranging equipment operations within the site to reduce sound transmission to the boundary or to noise sensitive locations.

4. Commercial Noise

A common noise source in commercial zones consists of equipment used for air-conditioning and refrigeration. Compressor units employed in air-conditioning and refrigeration systems are significant noise sources. Even when this type of equipment is enclosed within buildings, inadequate provisions are often made to control noise emissions. Air-intake and discharge openings in buildings containing systems for commercial use including stores, offices, hotels, restaurants, etc., permit noise leakage with resulting annoyance to neighbors. Other commercial noise sources include water chillers and pumps used for hot water circulators, auxiliary water supplies, etc.

Window and attic ventilating fans, particularly of large size, are sources of annoyance to neighbors. Frequently poorly located and improperly installed fans and packaged air-conditioning units are sources of annoying noise. The increasing use of air-conditioning units in both commercial and residential areas has led to numerous complaints of excessive noise.

5. Residential Area Noises

Many noise sources exist today in typical residential zones. Numerous day-to-day activities such as hobbies, entertainment, leisure time and maintenance functions include the use of motor-bikes, power mowers and trimmers, chain saws, home workshop power tools, etc. Also, do-it-yourself auto repair with accompanying work noises and testing runup sounds contribute to noise pollution levels in residential areas. Other common sources include a variety of vehicles including, police and fire vehicles, ambulances, garbage and delivery trucks. Trash and garbage collection has always been a major residential noise source. The handling of metal trash cans, engine exhaust sounds, brake squeals, operation of compactors, etc., contribute to a generally noisy and often disturbing operation.

Other common bothersome noises in residential areas include pets, children at play, and the operation of electronic equipment, including stereo equipment, radios and television sets. Barking dogs are one of the most frequent complaint sources after motor vehicle noises.

E. Noise Control Techniques

All noise problems can be divided into three basic components - the sound source, the transmission path and a human receiver. An understanding of the nature of sound generation, propagation and the impact on a receiver is imperative if noise control is to be effectively applied. The following sections present a summary of noise control fundamentals applicable to urban noise.

1. Source

Noise control approaches which are available to mitigate excessive noise from transportation sources include: (1) locating new roadways in locations where noise impacts will be minimal in relation to existing or future land uses; (2) reducing vehicle speeds in noise critical zones; (3) avoiding use of signals as accelerating and decelerating vehicles create more noise than smoothly flowing traffic; (4) controlling traffic flow rates to avoid increases in traffic; (5) maintaining roadways in good condition and using smooth surface materials and textures; (6) controlling heavy truck traffic routes and rerouting trucks where necessary; (7) in new roadway projects, use depressed or elevated designs to minimize impact on adjacent land areas; (8) avoid steep grades on roadways on which cars and trucks will produce more noise; (9) select roadway routes to obtain shielding from natural or man-made barriers; and (10) effectively enforce speed limits and proper maintenance of vehicle equipment.

Other noise control measures of significance at the community level would include the establishment of an anti-noise ordinance with quantitative or objective limits. A specific limit would be placed on various noise sources for given situations. As a minimum, it is necessary to specify what rating scale would be used and how the measurements were to be made. With measurement requirements and procedures specified, a quantitative standard can be readily enforced.

Noise control measures of significance at the State and Federal levels would include regulations setting noise emission limits on aircraft, trucks, buses, autos, railroads, construction equipment, home appliances, and powered tools and equipment.

2. Transmission Path

Noise control measures involved with changing the sound transmission path involves the use of natural or man-made barriers, shielding, baffling or use of enclosures. Generally, the greater the shielding effects are from the use of barriers or enclosures, the greater will be the attenuation results. Also, the more massive barriers will be more effective. Along roadways, barrier walls of adequate height and length when interposed between the vehicles and zone to be protected can yield up to 15 dBA or more of noise reduction. Shielding of a roadway can be obtained by elevating or depressing the

road into a cut. Depending on the height differential and the distances involved, sound level reductions up to 15 dB can be obtained.

On construction sites, the use of temporary enclosures or barriers around noisy machinery can be effective. On projects in already developed areas, intervening buildings will provide some noise reduction from shielding. Several rows of houses interposed between the work site and the receiver could yield up to 10 dB of noise reduction.

Frequently landscaping and use of trees are considered as a potential noise mitigation device. It has been found that landscaping alone is not a very effective noise barrier. Generally, 5 to 10 rows of closely spaced trees of 30 to 50 feet in height and blocking the line-of-sight are needed to obtain approximately 5 dB of noise reduction.

The most common form of noise enclosure in use in the community is a building structure. Structures can provide very significant amounts of noise reductions depending on the building design and major components including, walls, windows, doors, and openings. The following table of noise reductions was prepared from data contained in the Federal Highway Administration document, "Policy and Procedure Memorandum" PPM 90-2, February 8, 1973:

Noise Reduction from Building Structures

<u>Type of Building</u>	<u>Window/Condition</u>	<u>Exterior-to-Interior Noise Reduction (dB)</u>
All	Open	10
Light Frame	Ordinary, closed	20
Masonry	Single pane, closed	25
Masonry	Double pane, closed	35

The above noise reduction values will vary depending on the amount of glass-to-wall area, and the amount of leakage around window panels and frames. Other sources of noise leakage and flanking into buildings would include doors, ceiling, floors, ventilator openings, mail slots, fireplace flues and other openings to the outside. Therefore, effective noise control requires careful consideration of all potential leakage and flanking paths in building structures.

3. Human Receiver

It has long been known that exposure to sound of sufficient intensity for long periods of time can impair the human auditory system. Where mitigation measures cannot be effectively implemented on the sound source or transmission path, personnel protective devices must be employed. The wearing of ear plugs or muffs is a common technique used in the manufacturing industries and the airlines to protect employees from overexposures to harmful noise. The use of ear plugs and muffs requires proper fitting and maintenance to insure performance. The unsupervised use of personal protective devices would have limited success in the community.

Other measures should be employed to reduce sound intrusion. Proper site planning can remove the human as far as possible from the source. However, substantial distance separations must be made to obtain significant noise reductions. Site planning can utilize other structures such as commercial buildings, garages, etc. to acoustically shield noise sensitive facilities. Noise control approaches through land use changes are another means to isolate noise sensitive uses from locations of excessive noise. However, the total amount of noise impacted areas in many communities is so large that the amount of land needed for commercial and industrial uses (as noise buffer zones) would be impractically great.

Other factors should at times be considered when dealing with the human receiver. As the perception of sound is a subjective process, psychological factors play a part in individual expectations and response to noise. Often times human sensitivity to noise is influenced by other conditions related to a particular source of noise. For example, vehicular noise problems are often compounded by concerns over safety and other annoyances such as window vibrations and headlight glare. Where barriers and landscaping can be employed to eliminate light glare and to visually isolate the receiver from the source, the total annoyance can be reduced at the receiving location.

III. SCOPE OF NOISE SURVEY AND YEAR 2000 PREDICTIONS

A. Existing Noise Levels

To comply with the California Administrative Code Section 65302(g) and subsequent amendments to Noise Element requirements, noise level measurements were made to develop quantitative data to satisfy existing and future conditions. Continuous noise level recordings were made at 21 locations throughout the City during the daytime and nighttime hours. The recorded noise levels provided statistical data and the continuous equivalent sound level (L_{eq}) needed for the computation of the 24 hour day-night level (L_{dn}).

The following 21 noise survey locations shown in Table I below, were selected jointly with the City of Martinez Planning Department for the acquisition of data needed for the development of the noise contour maps enclosed herein. Continuous types of noise recordings were made with a Gen Rad Company Community Noise Analyzer, Type 1945. At each survey location, two hours of daytime noise and one hour of nighttime noise were recorded. Adjustments were made to the recorded levels, as necessary, to represent average daytime and nighttime levels. The railroad noise contours were developed from measurements of train passby levels with adjustments for daily traffic volumes and passages throughout the daytime and nighttime periods.

The following Table I shows the day-night levels which were calculated from the field data for each of the 21 survey locations at a specified distance from the centerline of the road.

TABLE I

Day-Night Levels (L_{dn})
From Major Traffic Sources and
The City of Martinez Filter Plant

<u>Source</u>	<u>L_{dn} (dB)</u>	<u>Distance from C.L. of Road</u>
1. Marina Vista	69	30 ft.
2. Highway 4	80	75
3. Alhambra Avenue	66	30
4. Berrellessa Road	67	26
5. Howe Road	71	21
6. Arnold Drive	67	35
7. Pacheco Boulevard	74	45 (Includes Filter Plant)
8. Center Avenue	62	22
9. Morrello Avenue	73	28
10. Pine Street	67	26
11. Shell Avenue	66	14
12. Escobar Street	64	30
13. Milano Way	60	20
14. Pleasant Hill Road	63	20
15. Alhambra Way	70	28
16. Blue Ridge	59	15
17. Southern Pacific RR	71	20
18. Glacier Drive	64	25
19. Palm Drive	65	10
20. Fig Tree Lane	59	15
21. Midway Drive	56	15

B. Future Noise Levels

Future traffic noise levels and contour locations were calculated from predicted changes in traffic volumes. Traffic volumes for the year 2000 were obtained from the City of Martinez and the existing General Plan - Year 2000 projections.

The following noise level increases were calculated for various segments of the roadways listed. No changes are shown for Highway 4 and the Southern Pacific Railroad:

TABLE II
Predicted Increases to Day-Night
Level (dB) Due to Projected Traffic
Volumes for the Year 2000

<u>Roadway</u>	<u>Segment</u>	<u>Present¹</u> <u>ADT</u>	<u>2000²</u> <u>ADT</u>	<u>Change</u> <u>in</u> <u>L_{dn}</u>
1. Marina Vista	Ref.	1,877	3,000	2.0
	A	1,877	3,000	2.0
	B	7,733	10,000	1.1
	C	8,636	11,000	1.1
	D	5,301	7,100	1.3
	E	10,995	14,000	1.0
2. Hwy 4	Ref.	No Change		
3. Alhambra Ave.	Ref.	6,287	8,300	1.2
	A	122	150	0.9
	B	1,058	1,750	2.2
	D	6,287	8,300	1.2
	E	11,937	16,000	1.3
	F	10,226	14,000	1.4
	G	24,547	32,000	1.2
	H	6,456	9,000	1.4
	I	7,888	11,000	1.4
	J	6,885	9,500	1.4
	K	9,530	12,200	1.1
	L	7,129	9,700	1.3
	M	7,703	10,300	1.3
	N	7,510	10,100	1.3

Table II (Con't.)

<u>Roadway</u>	<u>Segment</u>	<u>Present¹</u> <u>ADT</u>	<u>2000²</u> <u>ADT</u>	<u>Change</u> <u>in</u> <u>Lan</u>
3. Alhambra Ave.	O	8,546	12,500	1.7
	P	8,690	12,200	1.5
	Q	10,846	15,000	1.4
4. Berellessa Rd.	Ref.	3,778	5,250	1.4
	C	3,778	5,250	1.4
5. Howe Road	Ref.	4,392	12,100	4.4
	A	4,392	12,100	4.4
6. Arnold Dr.	Ref.	3,465	9,400	4.3
	A	3,465	9,400	4.3
	B	1,795	3,900	3.4
	C	1,912	3,900	3.1
	D	2,188	7,600	5.4
7. Pacheco Blvd.	Ref.	12,440	14,900	0.8
	A	12,440	14,900	0.8
8. Center Ave.	Ref.	2,895	3,200	0.4
	A	6,309	9,750	1.9
	B	2,379	5,430	3.6
	C	2,895	3,200	0.4
	D	3,418	3,800	0.5
	E	8,169	9,000	0.4
9. Morello Ave.	Ref.	4,576	7,450	2.1
	A	4,576	7,450	2.1
	B	7,444	14,000	2.7
	C	2,520	3,300	1.2
	D	2,531	3,300	1.2
10. Pine St.	Ref.	5,487	6,600	0.8
	A	5,487	6,600	0.8
	B	2,401	2,900	0.8
	C	1,568	1,900	0.8
	D	6,010		
	E	6,521	12,800	2.9
11. Shell Ave.	Ref.	2,905	3,200	0.4
	A	1,706	1,900	0.5
	B	2,905	3,200	0.4
	C	3,527	3,900	0.4

Table II (Con't.)

Roadway	Segment	Present ¹ ADT	2000 ² ADT	Change in L _{dn}
12. Escobar St.	Ref.	2,623	4,100	1.9
	A	2,623	4,100	1.9
	B	1,310	1,600	0.9
13. Milano Way	Ref.		2,800	
14. Pleasant Hill Rd.	Ref.	1,670		
	A	986	1,100	0.5
	B	2,354	2,600	0.4
15. Alhambra Way	Ref.	1,029	1,100	0.3
	A	1,029	1,100	0.3
	B	1,496	1,600	0.3
16. Blue Ridge	Ref.	3,173	3,700	0.7
	A	3,173	3,700	0.7
	B	2,938	3,500	0.8
17. SPRR	No Change			
18. Glacier Dr.	Ref.	896		
	A	1,207	3,425	4.5
	B	2,167		
	C	896		
	D	1,412		
19. Palm Dr.	Ref.			
20. Fig Tree Lane	Ref.		4,500	
21. Midway Drive	Ref.			

Note:

¹ City Estimates 1/21/85 (Average Daily Traffic)² Existing General Plan - Year 2000 Projections

Noise contour maps for existing and future year 2000 were prepared and are enclosed within the rear cover of this Noise Element. The noise contours are shown in 5 dB increments and are continued down to 60 dB L_{dn}.

IV. NOISE EXPOSURE INVENTORY

A noise exposure inventory for the City was prepared from housing data provided by the Planning Department and from the developed noise contours. The community noise exposure inventory includes current year 1985 and future year 2000 estimates of the number and percentage of persons exposed to various noise levels by tract numbers. Since the housing data were generalized and the noise contours are approximate, the number of persons exposed to various noise levels are estimates. The results are shown by tracts in the following table.

TABLE III

Year 1985 Martinez Population Exposed To Various Day-Night Levels

Tract	Pop.	<u>L_{dn} in dB</u>							
		<u>Up to 60</u>		<u>60-65</u>		<u>65-70</u>		<u>Over 70</u>	
		<u>Pop.</u>	<u>%</u>	<u>Pop.</u>	<u>%</u>	<u>Pop.</u>	<u>%</u>	<u>Pop.</u>	<u>%</u>
3160	1052	573	54.5	421	40.0	53	5.0	5	0.5
3170	1838	1011	55.0	735	40.0	92	5.0	--	--
3180	3242	3080	95.0	162	5.0	--	--	--	--
3190	3845	3653	95.0	154	4.0	38	1.0	--	--
3211.01	7243	6156	85.0	290	4.0	507	7.0	290	4.0
3211.02	3023	2932	97.0	91	3.0	--	--	--	--
3211.03	5393	4217	96.0	176	4.0	--	--	--	--
3200.01	462	388	84.0	49	10.5	23	5.0	2	0.5
3200.02	2557	2225	87.0	102	4.0	153	6.0	77	3.0
3212	128	111	87.0	5	4.0	8	6.0	4	3.0
3470	262	249	95.0	13	5.0	--	--	--	--
3560.02	51	48	95.0	3	5.0	--	--	--	--

TABLE III (Con't.)

Year 2000 Martinez Population Exposed
To Various Day-Night Levels

<u>Tract</u>	<u>Pop.</u>	<u>L_{dn} in dB</u>							
		<u>Up to 60</u>		<u>60-65</u>		<u>65-70</u>		<u>Over 70</u>	
		<u>Pop.</u>	<u>%</u>	<u>Pop.</u>	<u>%</u>	<u>Pop.</u>	<u>%</u>	<u>Pop.</u>	<u>%</u>
3160	1157	537	46.4	544	47.0	69	6.0	7	0.6
3170	2022	971	48.0	930	46.0	121	6.0	--	--
3180	3566	3380	95.0	178	5.0	--	--	--	--
3190	4230	3807	90.0	338	8.0	85	2.0	--	--
3211.01	7967	6772	85.0	319	4.0	558	7.0	318	4.0
3211.02	3325	3192	96.0	133	4.0	--	--	--	--
3211.03	4832	4590	95.0	242	5.0	--	--	--	--
3200.01	508	412	81.0	61	12.0	30	6.0	5	1.0
3200.02	2813	2222	79.0	197	7.0	253	9.0	141	5.0
3212	141	123	87.0	6	4.0	8	6.0	4	3.0
3470	288	274	95.0	14	5.0	--	--	--	--
3560.02	56	53	95.0	3	5.0	--	--	--	--

V. NOISE CRITERIA FOR LAND USE PLANNING

In general, most of the land within the City of Martinez that is used or planned for residential and other noise sensitive uses is adequately separated from sources of excessive noise. This is confirmed by our noise exposure inventory that revealed an estimated 88% of the population of the City of Martinez resides in zones having less than 60 dB L_{dn} of noise. Also, some areas that are exposed to excessive noise are occupied by noise insensitive uses. However, there are areas where environmental noise levels are or will be incompatible with certain land uses. In some cases, noises from transportation sources, such as the Southern Pacific Railroad and Highway 4, are unavoidable and difficult to abate within reasonable costs. Thus, high noise zones exist within the City and will continue to impact certain lands in the foreseeable future. Therefore, it is necessary to guide further development in a manner that will achieve compatibility with environmental noise exposure.

The concept of land use and noise compatibility should take into account the opportunities and responsibilities of noise sources to reduce noise emissions. Any source which affects other property to the extent that it limits the use of that property is indirectly imposing land use restrictions on that property. Thus, each noise producer should accept the responsibility of taking all reasonable measures to mitigate the noise to acceptable levels.

A major purpose of having a noise element in a general plan is to help achieve noise compatible land uses when new developments are proposed. Therefore, to avoid annoyance and health problems from exposure to excessive noise levels, all development proposals shall comply with the exterior and interior standards of Figures 1 and 2, and Table IV.

Where a detailed noise analysis is required, the applicant shall engage a competent acoustical engineer or consultant to prepare a report. The report shall include noise data obtained from on-site sound level measurements with appropriate temporal (day, evening and night) and spatial, if necessary, variations. The report shall include future noise levels due to predicted changes in roadway, railroad, aircraft, mass-transit, etc., traffic volumes. Where existing or future maximum allowable levels are exceeded, appropriate noise abatement measures shall be provided in the analysis report.

Figure 1

LAND USE COMPATIBILITY FOR COMMUNITY NOISE ENVIRONMENTS

LAND USE CATEGORY	COMMUNITY NOISE EXPOSURE L _{dn} OR CNEL, dB						INTERPRETATION
	55	60	65	70	75	80	
RESIDENTIAL - LOW DENSITY SINGLE FAMILY, DUPLEX, MOBILE HOMES							 NORMALLY ACCEPTABLE Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
RESIDENTIAL - MULTI-FAMILY							
TRANSIENT LODGING - MOTELS, HOTELS							 CONDITIONALLY ACCEPTABLE New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.
SCHOOLS, LIBRARIES, CHURCHES, HOSPITALS, NURSING HOMES							
AUDITORIUMS, CONCERT HALLS, AMPHITHEATRES							 NORMALLY UNACCEPTABLE New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
SPORTS ARENA, OUTDOOR SPECTATOR SPORTS							
PLAYGROUNDS, NEIGHBORHOOD PARKS							 CLEARLY UNACCEPTABLE New construction or development should generally not be undertaken.
GOLF COURSES, RIDING STABLES, WATER RECREATION, CEMETERIES							
OFFICE BUILDINGS, BUSINESS COMMERCIAL AND PROFESSIONAL							
INDUSTRIAL, MANUFACTURING UTILITIES, AGRICULTURE							

CONSIDERATIONS IN DETERMINATION OF NOISE-COMPATIBLE LAND USE

A. NORMALIZED NOISE EXPOSURE INFORMATION DESIRED

Where sufficient data exists, evaluate land use suitability with respect to a "normalized" value of CNEL or L_{dn}. Normalized values are obtained by adding or subtracting the constants described in Table 1 to the measured or calculated value of CNEL or L_{dn}.

B. NOISE SOURCE CHARACTERISTICS

The land use-noise compatibility recommendations should be viewed in relation to the specific source of the noise. For example, aircraft and railroad noise is normally made up of higher single noise events than auto traffic but occurs less frequently. Therefore, different sources yielding the same composite noise exposure do not necessarily create the same noise environment. The State Aeronautics Act uses 65 dB CNEL as the criterion which airports must eventually meet to protect existing residential communities from unacceptable exposure to aircraft noise. In order to facilitate the purposes of the Act, one of which is to encourage land uses compatible with the 65 dB CNEL criterion wherever possible, and in order to facilitate the ability of airports to comply with the Act, residential uses located in Com-

munity Noise Exposure Areas greater than 65 dB should be discouraged and considered located within normally unacceptable areas.

C. SUITABLE INTERIOR ENVIRONMENTS

One objective of locating residential units relative to a known noise source is to maintain a suitable interior noise environment at no greater than 45 dB CNEL of L_{dn}. This requirement, coupled with the measured or calculated noise reduction performance of the type of structure under consideration, should govern the minimum acceptable distance to a noise source.

D. ACCEPTABLE OUTDOOR ENVIRONMENTS

Another consideration, which in some communities is an overriding factor, is the desire for an acceptable outdoor noise environment. When this is the case, more restrictive standards for land use compatibility, typically below the maximum considered "normally acceptable" for that land use category, may be appropriate.

Figure 2

INTERIOR NOISE LEVELS (L_{dn})
CONSIDERED COMPATIBLE FOR VARIOUS USES

Use	L_{dn}
<u>RESIDENTIAL</u>	45
<u>COMMERCIAL</u>	
Hotel-Motel	45
Executive Offices, Conference Rooms	55
Staff Offices	60
Restaurant, Markets, Retail Stores	60
Sales, Secretarial	65
Sports Arena, Bowling Alley, etc.	75
<u>INDUSTRIAL</u>	
Offices (same as above)	55-60
Laboratory	60
Machine Shop, Assembly, & Others	75
<u>PUBLIC OR SEMI-PUBLIC FACILITY</u>	
Concert Hall & Legitimate Theater	30
Auditorium, Movie Theater & Church	45
Hospital, Nursing Home & Firehouse (sleeping quarters)	45
School Classrooms	50
Library	50
Other	55

Source: State Office of Noise Control

TABLE IV

Corrections to be Added to the
Measured Day-Night Level (L_{dn})
to Obtain Normalized L_{dn}

Type of Correction	Description	Amount of Correction to be Added to Measured L_{dn} in dB
Seasonal Correction	Summer (or year-round operation).	0
	Winter only (or windows always closed).	-5
Correction for Outdoor Residual Noise Level	Quiet suburban or rural community (remote from large cities and from industrial activity and trucking).	+10
	Quiet suburban or rural community (not located near industrial activity).	+5
	Urban residential community (not immediately adjacent to heavily traveled roads and industrial areas).	0
	Noisy urban residential community (near relatively busy roads or industrial areas).	-5
	Very noisy urban residential community.	-10
Correction for Previous Exposure and Community Attitudes	No prior experience with the intruding noise.	+5
	Community has had some previous exposure to intruding noise but little effort is being made to control the noise. This correction may also be applied in a situation where the community has not been exposed to the noise previously, but the people are aware that bona fide efforts are being made to control the noise.	0
	Community has had considerable previous exposure to the intruding noise and the noise maker's relations with the community are good.	-5
	Community aware that operation causing noise is very necessary and it will not continue indefinitely. This correction can be applied for an operation of limited duration and under emergency circumstances.	
Pure Tone or Impulse	No pure tone or impulsive character.	0
	Pure tone or impulsive character present	+5

Source: State Office of Noise Control

VI. MITIGATING MEASURES FOR NOISE CONTROL

From the noise survey, the City of Martinez day-night level of noise was found to range from 56 dB to 80 dB. Four of the twenty-one noise survey sites were found to have levels of 60 dB L_{dn} or less. Thus, seventeen sites exceeded 60 dB L_{dn} .

The above levels exist at close proximity to the roadways and railroad and do not accurately represent the noise impingement levels on residential buildings and other structures. However, the potential exists for creating annoyance, sleep interference and other problems. This section recommends methods of achieving an overall improvement in the noise environment of the City by reducing noise and its effects. Specific measures which can be taken, can be categorized into administrative actions or technical control approaches. The following are specific means of achieving noise mitigation:

- . Avoiding the placement of noise sensitive recipients in noise impacted areas where noise abatement is impossible.
- . Removing the source of noise.
- . Quieting the noise at the source.
- . Extending the path of noise from its source to the receiver.
- . Shielding the noise source or the recipient of the noise.

A. Administrative Controls

One of the first steps in combating noise within the City of Martinez is to organize certain City resources for the assessment and control of noise. Although Federal, State and County agencies are dealing with some of the sources of noise affecting Martinez, there are significant aspects of noise that can be controlled locally.

The following list has been prepared by the League of California Cities as specific recommendations to aid in solving community noise problems:

1. Each City Council should adopt a policy statement for reducing noise in the community as part of a broad approach to environmental quality control.
2. Cities should adopt a noise ordinance to prohibit unwanted and unnecessary sounds of all types within the community.
3. Cities should review their existing ordinances which relate to noise control for compatibility with the above.
4. Cities should undertake a study of noise sources in the community (part of the Noise Element).
5. Cities should develop a noise enforcement and regulation program and consider assigning an existing staff member or creating an administrative position within the City to be concerned with noise problems. Such a staff person could be in the Planning Department, Building Department, Police Department, Administrative Office or Environmental Control Division.
6. Cities should review their own functions and activities to make sure that noise, such as construction, refuse collection, and street sweeping has been reduced to the lowest possible level.
7. Cities should enforce the motor vehicle code as it applies to excessive noise.
8. Cities should conduct an educational campaign consisting of civic group presentations, news releases, studies and reports to inform citizens of the dangers of noise and the actions each person can take to help reduce noise pollution.
9. Cities should incorporate noise standards in zoning ordinances which will prohibit incompatible land uses with respect to noise.

10. Cities should adopt building codes to insure adequate sound insulation between dwelling units, and where appropriate, to insure adequate sound insulation of interior areas of both apartments and single family residences from especially loud external noise sources.
11. Cities should consider the development of "quite zones" in special areas of the City, perhaps in already existing recreation areas. All forms of noise would be controlled so that people could visit and enjoy solitude as part of their recreation and leisure experience.
12. Cities should include maximum noise level requirements in specifications for equipment purchases, construction contracts and refuse collection. Where specific noise levels cannot be set, specifications should require that vendors state maximum noise levels expected to be produced by their equipment and/or operations.
13. Cities should review and reevaluate their traffic flow systems to synchronize signalization to avoid traffic stops which produce excessive noise, and to adjust traffic flow to achieve noise levels acceptable to surrounding areas.
14. Cities should seek to develop regional planning agreements for zoning to reduce noise incompatibilities across city boundaries.
15. Cities should review county and regional comprehensive plans to identify noise environmental impact and develop alternatives for the control of major noise sources. In any single function of county or regional plans for transportation, airport development, highway development, etc., the same provisions should apply.
16. Cities should contact state and federal officials to convey their concern over noise problems and encourage residents to do the same. Many aspects of noise pollution require state or federal action and governmental officials at all levels should be aware of public need for a solution to noise problems.

B. Technical Noise Control Measures

Prior to the start of design of noise mitigating measures, it is necessary to quantify the amount of noise excess creating the problem. Usually an assessment of the problem is made by measuring the noise emission level of the offending source and comparing it against the ambient, without the source. Some judgment can be made of the noise excess over an acceptable level by reference to Tables V and VI.

TABLE V

ESTIMATED COMMUNITY RESPONSE TO SOUND LEVEL INCREASES

<u>Sound Level in dBA</u> <u>Above the Acceptable Level</u>	<u>Estimated</u> <u>Community Response</u>
0	No observed reaction
5	Sporadic complaints
10	Wide spread complaints
15	Threats of action
20	Vigorous action

Source: A Report to the 1971 Legislature on the Subject
of Noise Pursuant to Assembly Concurrent Resolution 165
(Sacramento: California Department of Public Health, 1971)
P. 34.

TABLE VI

PERCENTAGES OF PERSONS HIGHLY ANNOYED WHO
REGISTER COMPLAINTS AS A FUNCTION OF L_{dn}

<u>L_{dn} (dB)</u>	<u>Percentage of Highly Annoyed</u>	<u>Percentage Of Complaints</u>
50	13	Less than 1
55	17	1
60	23	2
65	33	5
70	44	10
75	54	15
80	62	Over 20

Source: Harry Heuman, "Noise: Our Clandestine Pollutant,"
Proceedings of the International Conference on Urban Housing
and Transportation, June 1-4, 1975, Detroit, P. 193.

1. Noise Control Measures

a. General

The widespread concern over urban noise and control has resulted from the increased use of powered vehicles and equipment, an increasing population density, growing use of mass transportation systems and a growing awareness of the detrimental effects of noise on people.

As mentioned earlier in this Element, all noise problems consist of three basic components: (1) the noise source, (2) the noise transmission path, and (3) the receiver. The following paragraphs briefly describe some of the noise control measures in common use.

Most of the noise control alternatives involve the use of one or more of several mitigation measures. These include noise reduction at the source; increased separation distance between the source and receiver; the use of sound enclosures, barriers, or better sound insulating components; scheduling; and zoning

b. Noise Control at the Source

Redesign or modify the source. Generally, modification of the source is the most desirable approach. However, this solution is often economically and technically impractical and the City may not have the necessary legal authority to take this approach.

Use a less noisy source. Use a barrier or enclosure on the source.

c. Lengthen or Modify the Transmission Path

Introduce solid, air-impervious barriers between the noise source and receiving points to at least block the line-of-sight path between the two points.

Use natural terrain features to introduce an obstruction in the path.

Provide an earthen berm of sufficient height and length.

Build a solid, air-impervious wall of pre-cast concrete, cement block, wood or stucco wall of proper surface density, height and length.

Provide sufficient separation distance between the source and the receiving points to attenuate noise to acceptable levels.

d. Enclose the Receiver

Enclosing the receiver can be accomplished by the use of building structures. This method can yield acceptable results if the building envelope is properly designed for sound control. If people cannot be enclosed by a building and must remain outdoors, personal protective devices, such as, ear plugs or muffs would provide limited protection.

e. Scheduling

Where practical, noisy events should be scheduled when people would be least likely to be disturbed. Scheduling noisy activities for the daytime period will result in fewer complaints as compared to evening or nighttime operations.

f. Zoning

Proper use of zoning by the City can be effective for noise control because of the effects on density, building height and location.

2. Roadway Noise Control

Of the numerous sources of noise in urban areas, the motor vehicle has been the main source and the principal target for noise abatement. As federal and state agencies have preempted the cities with noise control regulations on motor vehicles, local jurisdictions can participate in enforcement of the regulations. Martinez should support federal and state authorities in actions for quieter designs of trucks, buses, motorcycles and passenger automobiles.

Martinez can control some aspects of roadway noise other than the source itself. Noise from roadways can be controlled to a limited extent by various methods as follows:

a. Roadside Noise Barriers

The basic requirement for a roadway noise barrier is that it must shield the view of the vehicles from the location to be protected. Also, the barrier must be built and located to prevent sound from flanking the ends of the barrier and also minimize transmission of reflective and refractive components by other paths.

b. Depressed Roadways

A depressed roadway will transmit less noise to adjacent areas because of shielding effects from the embankment along the cut. Depending on the depth of the roadway cut and distances, the excess attenuation can approach 15 dBA.

c. Elevated Roadways

Similar to depressed roadways, elevated roads having a vertical displacement in relationship to adjoining land will provide acoustic shielding from portions of the elevated structure. A roadway with a 25 ft. elevation will provide approximately 10 dBA of excess attenuation at a 200 ft. distance as compared to an on-grade road. Additional noise reductions can be obtained from solid, air-impervious walls or berms along elevated sections of roads.

d. Plantings as Roadway Barriers

Contrary to widespread belief, trees and shrubbery are not effective as roadway noise barriers. Plantings do not possess the physical properties needed for a good sound barrier. As trees and shrubs are porous to air flow and lack mass, their permeability to sound transmission is great and, therefore, are poor sound barriers. Generally, it is necessary to have 75-100 ft. of depth of plantings of great density from the ground to elevations of 30-50 ft. to obtain 5 dBA of noise reduction. Plantings as roadside noise barriers usually provide a psychological and aesthetic benefit.

3. Noise Control for Buildings

Control of intrusive noise in buildings has become more of a problem in recent years due to various reasons, including:

- . Locating buildings near noise sources.
- . Use of lighter weight construction materials
- . Increasing use of glass and open concepts in designs
- . Inadequate attention to details concerned with sound control
- . Improper floor plan arrangements
- . Improper orientation and location of buildings in relation to nearby noise sources
- . Inadequate use of natural noise barriers, such as hills, grades, etc.

The following methods of siteing, orientation and construction will assist in obtaining lower noise levels within buildings:

- a) Maintain adequate separation distance from noise source.
- b) Use berms or walls as exterior noise barriers.
- c) Site buildings to take advantage of natural barriers.
- d) Orient buildings to reduce noise impingement on exterior surfaces by having the long axis of the buildings perpendicular to the highway.
- e) Avoid parallel building arrangements whereby sound buildup and reflections can occur between buildings.
- f) Where possible, locate buildings on the windward or upwind side of the road. The upwind side is usually quieter than the downwind side.
- g) Arrange interior spaces to have noisy spaces on the roadway side of the building. Conversely, place noise sensitive spaces such as bedrooms on the quiet side.
- h) For excessively noisy interior exposures, provide mechanical ventilation or air-conditioning to permit closing of windows during noisy periods.

VII. RELATIONSHIP WITH OTHER GENERAL PLAN ELEMENTS

It was shown in a previous section that the population of Martinez in the year 2000 will be subjected to more noise than the current population. This prediction for the year 2000 is based on traffic projections showing greater traffic volumes on City and other area roadways. Thus, a problem of noise will continue into the short-term future. This condition, if it is to be controlled or abated, requires directing residential development into the more quiet areas or implementing measures for effective noise reduction.

The Land Use Element of the General Plan should, therefore, take a conservative approach of assuming that current levels of noise will remain. Accordingly, certain types of noise-sensitive development, such as residential, should be directed into acceptable noise zones. However, if it is anticipated that existing zones of excess noise will be made acceptable, noise-sensitive developments should not be precluded.

The Circulation Element should consider the relationship between traffic volumes and noise. Traffic noise increases in proportion to traffic volume by approximately 3 dB for each doubling of the volume. Also, traffic noise increases with speed and the volume of heavy-duty trucks. Thus, as average speeds are increased and with greater truck traffic volumes, urban noise levels will increase. This situation will require new routes, wider rights-of-way, noise barriers or other noise mitigating measures being incorporated in traffic planning. The Circulation Element should be reviewed periodically for possible changes in noise emission levels from changes in traffic patterns.

The City's Subdivision Ordinance should be considered for a role in implementing the Noise Element. The noise compatibility of a proposed subdivision should be a basic factor in considering approval of a proposed subdivision. For some proposed developments, large setbacks and particular building orientations may be required to preclude future noise problems.

APPENDIX A

APPENDIX A

CITY OF MARTINEZ NOISE SURVEY

<u>Site and Microphone Location</u>	<u>Time</u>	<u>Sound Levels (dBA)</u>						<u>L_{dn} (dB)</u>
		<u>L_{max}</u>	<u>L₁₀</u>	<u>L₅₀</u>	<u>L₉₀</u>	<u>L_{min}</u>	<u>L_{eq}</u>	
1. Marina Vista near Castro, 30' from C.L.	12:00 noon-1:00 pm	90	67	58	53	48	65	69
	1:00-2:00 pm	88	65	53	47	45	63	
	10:00-11:00 pm	86	63	50	45	42	62	
2. Southern Pacific RR near RR Depot, 20' from C.L. of nearest tracks	8:00-9:00 am	93	71	64	54	50	70	71
	9:00-10:00 am	98	66	55	51	48	64	
	12:00 midnt.-1:00 am	90	55	48	46	44	64	
3. Berellessa Rd. near Main St., 26' from C.L.	2:00-3:00 pm	82	67	58	50	45	64	67
	3:00-4:00 pm	82	67	59	52	44	64	
4. Alhambra Ave. near Jones, 30' from C.L.	4:30-5:30 pm	80	68	59	48	43	64	66
	5:30-6:30 pm	82	68	59	49	45	64	
	2:00-3:00 am	78	52	45	44	41	55	
5. Pine Street near Miller, 26' from C.L.	6:30-7:30 pm	86	67	57	47	41	64	67
	7:30-8:30 pm	83	67	56	45	41	63	
	1:00-2:00 am	75	61	46	41	39	57	
6. Pacheco Blvd. near Howe Rd., 45' from C.L.	10:00-11:00 pm	88	73	68	66	64	71	74
	11:00 pm-12:00 mdnt.	91	74	69	65	63	71	
	3:00-4:00 am	86	67	66	65	63	67	

APPENDIX A

CITY OF MARTINEZ NOISE SURVEY

<u>Site and Microphone Location</u>	<u>Time</u>	<u>Sound Levels (dBA)</u>						<u>L_{dn} (dB)</u>
		<u>L_{max}</u>	<u>L₁₀</u>	<u>L₅₀</u>	<u>L₉₀</u>	<u>L_{min}</u>	<u>L_{eq}</u>	
7. Howe Road near Pacheco, 21' from C.L.	12:00 noon-1:00 pm	89	74	63	60	57	70	71
	1:00-2:00 pm	92	73	63	60	57	70	
	2:00-3:00 am	89	58	56	54	52	62	
8. Arnold Drive near Morello, 35' from D.L.	2:00-3:00 pm	83	69	63	58	53	66	67
	3:00-4:00 pm	91	69	62	58	54	66	
	12:00 mdnt.-1:00 am	88	60	55	50	45	59	
9. Morello Ave. near Village Oaks, 28' from C.L.	4:00-5:00 pm	95	74	64	54	43	71	73
	5:00-6:00 pm	93	74	65	55	44	70	
	10:00-11:00 pm	81	68	58	51	47	65	
10. Midway Drive	10:00-11:00 am	81	55	47	43	40	55	56
	11:00 am-12:00 noon	79	57	47	42	38	55	
	11:00 pm-12:00 mdnt.	76	49	44	41	37	47	
11. Highway 4, near Morello, 15' from edge of right-of-way	8:00-9:00 am	101	84	78	72	63	81	80
	9:00-10:00 am	101	83	76	69	61	80	
	1:00-2:00 am	86	67	56	45	40	65	
12. Center Ave. on Pine Meadow Golf Course, 22' from C.L.	3:00-4:00 pm	89	65	50	44	40	63	62
	4:00-5:00 pm	83	65	61	46	40	61	
	12:00 mdnt.-1:00 am	77	49	46	44	42	51	

APPENDIX A

CITY OF MARTINEZ NOISE SURVEY

Site and Microphone Location	Time	Sound Levels (dBA)						L _{dn} (dB)
		L _{max}	L ₁₀	L ₅₀	L ₉₀	L _{min}	L _{eq}	
13. Milano Drive near Brittany Lane, 5' from edge-of- pavement	8:00-9:00 pm	76	53	50	47	44	52	60
	9:00-10:00 pm	76	53	50	47	43	52	
	10:00-11:00 pm	76	55	51	48	45	53	
14. Glacier Drive near Center Ave., 25' from C.L.	5:00-6:00 pm	80	67	60	53	45	65	64
	6:00-7:00 pm	81	67	60	55	49	63	
	11:00 pm-12:00 mdnt.	82	57	49	46	44	56	
15. Pleasant Hill Rd. near Boyd Park, 5' from edge-of- pavement	4:00-5:00 pm	79	57	49	43	38	57	63
	5:00-6:00 pm	80	59	50	44	39	59	
	1:00-2:00 am	77	56	43	35	33	56	
16. Alhambra Way near Linden Lane, 3' from edge-of- pavement	9:00-10:00 am	86	60	49	44	39	61	70
	10:00-11:00 am	82	58	45	41	38	60	
	2:00-3:00 am	97	49	40	38	37	64	
17. Escobar Ave. near Alhambra Way, 30' from C.L.	5:30-6:30 am	76	60	51	47	45	58	64
	7:00-8:00 am	83	60	53	50	40	58	
	8:00-9:00 am	83	62	55	51	45	58	
18. Palm Drive near Merle Ave., 10' from C.L.	12:00 noon-1:00 pm	89	66	54	50	45	63	65
	1:00-2:00 pm	92	64	53	48	45	63	
	4:00-5:00 am	76	55	54	52	49	54	

APPENDIX A

CITY OF MARTINEZ NOISE SURVEY

<u>Site and Microphone Location</u>	<u>Time</u>	<u>Sound Levels (dBA)</u>						<u>L_{dn} (dB)</u>
		<u>L_{max}</u>	<u>L₁₀</u>	<u>L₅₀</u>	<u>L₉₀</u>	<u>L_{min}</u>	<u>L_{eq}</u>	
19. Shell Avenue, 14' from C.L.	2:00-3:00 pm	88	68	55	50	47	65	66
	3:00-4:00 pm	93	69	56	50	44	65	
	5:00-6:00 am	75	59	55	52	49	57	
20. Fig Tree Lane near Hatchwood Ct., 15' from C.L.	6:00-7:00 pm	83	55	48	46	42	57	59
	7:00-8:00 pm	75	56	50	48	47	54	
	11:00 pm-12:00 mdnt.	76	54	49	45	42	51	
21. Blue Ridge Drive, 15' from C.L.	8:00-9:00 pm	80	57	43	40	38	54	59
	9:00-10:00 pm	79	57	42	39	36	54	
	10:00-11:00 pm	77	53	42	39	37	52	

APPENDIX B

APPENDIX B

DEFINITIONS

Acoustics: (1) The science of sound, including the generation, transmission and effects of sound waves, both audible and inaudible.

(2) The acoustics of an auditorium or of a room, the totality of those physical qualities (such as size, shape, amount of sound absorption, and amount of noise) which determine the audibility and perception of speech and music.

"A" Weighted Levels: Sound levels obtained using one of the frequency weighting networks, the "A" network, of the sound level meter. The "A" weighting approximates the response of the ear and "A" weighted levels are commonly used as a measure of the human annoyance response to noise.

Ambient Noise (Background Noise): The total of all noise in a system or situation, independent of the presence of the desired (or undesired) signal.

Average Daily Traffic (ADT): The total volume during a given time period in whole days greater than one day and less than one year divided by the number of days in that time period, commonly abbreviated as ADT.

CNEL - Community Noise Equivalent Level: A noise rating scheme defined in California Administrative Code based on a process of sound energy averaging and with weighting factors applied to daytime, evening and nighttime noise exposures.

Daytime: Between the hours of 7:00 a.m. and 7:00 p.m.. Evening: Between the hours of 7:00 p.m. and 10:00 p.m. Nighttime: Between the hours of 10:00 p.m. and 7:00 a.m.

dB (Decibel): A unit of level or logarithmic representation of magnitude when the base of the logarithm is the tenth root of ten and the quantities concerned are proportional to power, such as sound pressure squared. The logarithm to the base the tenth root of 10 is the same as ten times the logarithm to the base 10.

dba (Decibel A Scale): Measure of decibel using the "A" scale or "A" weighted network of the sound level meter. The "A" scale is the sound measuring scale that most closely correlates with the loudness of sounds as perceived by the human ear.

Fluctuating Noise: Continuous noise whose level varies appreciably (more than +5 dB) with time.

Frequency: (In cycles per second or hertz). The time rate of repetition of a periodic phenomenon. The frequency is the reciprocal of the period.

Hertz: Unit of measurement of frequency, numerically equal to cycles per second.

Histogram: Graph showing the fraction of time that the instantaneous pressure level or other variable lies above or below a given level.

Impulsive Noise: Noise of short duration (typically, less than one second) especially of high intensity, abrupt onset and rapid decay and often rapidly changing spectral composition.

Land Use Area: Reasonably homogenous and identifiable areas composed of similar general types of land uses such as residential, commercial or industrial districts.

L_{10} , L_{50} , L_{90} Sound Level: That sound level which is exceeded 10%, 50% or 90% of a specified period of time. For example, the L_{10} sound level for a daily period is that sound level which is exceeded for 10% of 24 hours, or for 2.4 hours. The L_{10} represents a reasonable estimate of the "intrusive" noise level, the L_{50} the "average" level and the L_{90} the "background" level.

L_{eq} - Energy Equivalent Sound Level: Sound level based on the average of "A" weighted sound energy or sound pressure squared for a noise exposure over a specified period of time.

L_{dn} - Day-Night Average Sound Level: Sound level averaged on the basis of "A" weighted sound energy or sound pressure squared for a 24 hour noise exposure including a 10 dBA weighting penalty added to sound levels for the nighttime hours.

Level: In acoustics, the level of a quantity is the logarithm of the ratio of that quantity to a reference quantity of the same kind. The base of the logarithm, the reference quantity and the kind of level must be specified.

Loudness: The intensive attribute of an auditory sensation, in terms of which sounds may be ordered on a scale extending from soft to loud.
Note: Loudness depends primarily upon the sound pressure of the stimulus, but it also depends upon the frequency and wave form of the stimulus.

Noise: Any undesired sound. By extension, noise is any unwanted disturbance within a useful frequency band, such as undesired electric waves in a transmission channel or device.

Noise Level: The level of noise. For airborne sound unless specified to the contrary, noise level is the weighted sound pressure level called sound level; the weighting must be indicated.

Sound: (1) An oscillation in pressure, density, particle displacement, particle velocity, etc., which propagates, or travels as a wave, in a medium.
(2) An auditory sensation evoked by the oscillation described above.
Note 1. In case of possible confusion the term "sound wave" or "elastic wave" may be used for concept (1) and the term "sound sensation" for concept (2). Not all sound waves can evoke an auditory sensation, e.g., ultrasound.
Note 2. The medium in which the source exists is often indicated by an appropriate adjective, e.g., airborne, waterborne, structureborne.

Sound Insulation: (1) The use of structures and materials designed to reduce the transmission of sound from one room or area to another, or from the exterior to the interior of a building.
(2) The degree by which sound transmission is reduced by means of sound insulating structures and materials.

Sound Level (noise level): Weighted sound pressure level measured by the use of a metering characteristic and weighting A, B or C, as specified in American National Standard Specification for Sound Level Meters, S1.4-1971, or the latest approved revision thereof. The weighting employed must be indicated, otherwise the "A" weighting is understood. The reference pressure is 20 micronewtons per square meter (2×10^{-4} dyne/cm²).

Sound Pressure Level: In dB, is 20 times the logarithm to the base 10 of the ratio of the pressure of this sound to the reference pressure. The reference pressure shall be explicitly stated.

Note 1. The reference pressure 2×10^{-4} dyne/cm² is in general use for measurements concerned with hearing and with sound in air.

Note 2. Unless otherwise explicitly stated, it is to be understood that the sound pressure is the effective (rms) sound pressure.

Sound Transmission Class (STC): The preferred single figure rating system designed to give an estimate of the sound insulation properties of a partition or a rank ordering of a series of partitions.

Transient Sounds: Sounds whose average properties do not remain constant in time. Examples are an aircraft flyover, a passing truck, a sonic boom.

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